

ORIGINAL

Before the  
**FEDERAL COMMUNICATIONS COMMISSION**  
Washington, D.C. 20554

In the Matter of

Petition for Allocation of  
Radio Spectrum in the 2 GHz  
Band for the Provision of  
Wireless Fixed Access Local  
Loop Services

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## SUMMARY

As detailed in these comments, Nortel supports DSC's request for an allocation of spectrum for what Nortel refers to as fixed wireless access ("FWA") service. There is presently a demand for such an offering that cannot suitably be met by the current (or planned) allocations, and wireline solutions are inadequate. Nortel thus urges the Commission to initiate a rulemaking to allocate spectrum for such a service.

Nortel, however, disagrees with some of the technical aspects of DSC's petition. Nortel believes that the public interest would be better served if the Commission proposed an allocation of 300 MHz of contiguous spectrum for the FWA service rather than the more restrictive allocation suggested by DSC. Nortel also disagrees with DSC's petition to the extent it suggests that an FWA allocation needs to be confined to at or below the 2 GHz band. Nortel believes that a 300 MHz contiguous allocation would present better opportunities for intra- and inter-service competition, allow greater flexibility in selecting technology, and conform with allocations for similar services in other countries.

Nortel believes that an FWA service will provide many benefits. FWA will allow the prompt deployment of service to areas that are not served or underserved at present. FWA will also provide a means for competitive, facilities-based entry into the local services marketplace. In addition, FWA will improve education opportunities and lead to the creation of numerous jobs. In order that these various benefits be realized, Nortel

urges the Commission to adopt a Notice of Proposed Rulemaking for an FWA service consistent with these comments.

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Comments of Nortel on the Petition for Rulemaking

Northern Telecom Inc. ("Nortel") hereby comments on the petition for rulemaking submitted by DSC Communications Corporation ("DSC") seeking an allocation of spectrum for a wireless fixed access local loop service.<sup>1/</sup> As detailed herein, Nortel supports DSC's request for an allocation of spectrum for what Nortel refers to as fixed wireless access ("FWA") service. There is presently a demand for such an offering that cannot suitably be met by the current (or planned) allocations, and wireline solutions are inadequate. Nortel thus urges the Commission to initiate a rulemaking to allocate spectrum for such a service.<sup>2/</sup>

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<sup>1/</sup> Public Notice, Report No. 2142, released July 11, 1996 (hereafter cited as "DSC Petition").

<sup>2/</sup> Although Nortel refers to FWA as a "service" in accordance with Commission convention, Nortel does not expect FWA to be offered to the public as a separate or distinct service. FWA is a wireless point-to-multipoint service that will be used by telecommunications carriers as an alternative or complementary

(continued...)

As also detailed below, however, Nortel disagrees with some of the technical aspects of DSC's petition. Nortel believes that the public interest would be better served if the Commission proposed an allocation of 300 MHz of contiguous spectrum for the FWA service rather than the more restrictive allocation suggested by DSC. Nortel also disagrees with DSC's petition to the extent it suggests that an FWA allocation needs to be confined to at or below the 2 GHz band. Nortel believes that a 300 MHz contiguous allocation would present better opportunities for competition, allow greater flexibility in selecting technology, and conform with allocations for similar services in other countries.

Nortel is the leading global supplier, in more than 100 countries, of digital telecommunications systems to businesses, universities, local, state and federal governments, the telecommunications industry, and other institutions. The company employs more than 23,000 people in the United States in manufacturing plants, research and development centers, and in marketing, sales and service offices across the country.

Wireless Networks is one of three major network businesses based in Richardson, Texas, where Nortel employs more than 5,000 people. Nearly 2,000 of those employees are in Wireless Networks, which addresses global growth markets for digital cellular, PCS, and wireless access. Nortel is already

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<sup>2/</sup>(...continued)

technology to provide "wireline equivalent" services to customers on the same (and interchangeable) basis as traditional wireline "local loop" technologies, in much the same way as the existing Fixed point-to-point wireless service is used as an alternative or complementary technology to feeder or trunk cables.

deploying FWA services in a number of countries, and is thus highly interested in DSC's petition for rulemaking.

Nortel is also well qualified to address the issues raised in DSC's petition. As a major supplier of switching, transport, access and wireless systems (including all traditional and emerging technologies) to most sectors of the telecommunications industry, Nortel is well-positioned to understand all aspects of the evolution, planning and deployment puzzle for the regulated, unregulated, embedded and competitive players in the market. Nortel is able to convert technologies and products into effective solutions and differentiated service platforms without undue bias, and render objective advice to operators, investors, planners (and regulators) trying to steer their way through the complex array of options and alternatives. Nortel has carefully studied the various demands and technologies, and Nortel believes that FWA services should be made available to all carriers and customers as a component of the increasingly complex telecommunications infrastructure.<sup>3/</sup>

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<sup>3/</sup> Nortel has concerns about the rules to be proposed regarding the licensing and operation of an FWA service. For example, FWA serving areas will not correspond to any existing geographic mapping and the markets will number in the thousands rather than hundreds as they do for CMRS. This suggests a different approach is needed to licensing than the one currently used for CMRS. Nortel plans to address those issues in the context of a specific notice of proposed rulemaking.



I. Nortel Urges the Commission to Allocate  
Spectrum for a Fixed Wireless Access Service

A. Nortel Has Previously Supported an FWA Allocation

Even before DSC submitted its petition for rulemaking, Nortel had been an advocate for an FWA service in the United States. As Nortel observed when commenting on the Commission's proposal to allow fixed services in CMRS spectrum:

The Commission's proposal to allow CMRS providers to offer fixed services is a positive step towards facilitating the rapid availability of fixed wireless local loop services. Nortel believes, however, that more needs to be done. Although it is beyond the scope of this rulemaking, Nortel urges the Commission to begin to consider allocating additional spectrum dedicated to fixed wireless services. The needs for these services cannot adequately be fulfilled simply by allowing CMRS providers to offer fixed wireless local loop services.<sup>4/</sup>

Nortel thus is in full agreement with the spirit (and many of the details) of the DSC proposal.

Nortel's support is based on its experiences to date with FWA services in other countries. Nortel is already deploying similar systems in current (or soon-to-be) operational networks in almost a dozen countries worldwide, including the United Kingdom, Finland, Australia, Bolivia, Colombia and Sri Lanka, and Nortel expects a further twenty countries will be added to this list by the end of 1996. The same technological,

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<sup>4/</sup> Comments of Nortel in WT Docket No. 96-6, submitted March 1, 1996 at pp. 4-5. See also, Remarks of David Twyver at the Commission's *En Banc* Hearing on Spectrum Policy, March 5, 1996.

economic and service benefits that have supported an FWA service in these other countries are applicable here.

B. There Is Significant Demand for FWA

There is at present a significant unmet demand for service that can best be provided by an FWA service. An FWA service would allow a competitive local exchange carrier to deploy a ubiquitous, robust network in a timely and economical manner. Thus, an FWA service has the capability of greatly enhancing competition. The Commission well recognizes the benefits of enhanced competition, including lower prices, greater choice and increased innovation.<sup>5/</sup> In fact the Telecommunications Act of 1996 recognizes the importance of facilities based competition in the local loop for both residential and business subscribers when it made this a requirement before a Bell Operating Companies could provide in-region interLATA toll services.<sup>6/</sup>

Notwithstanding the legal and regulatory changes resulting from the Telecommunications Act of 1996, the development of such facilities-based competition is expected to be slow in materializing, especially for medium and low-density subscribers, because of the high cost of deploying traditional wire, coaxial cable and fiber plant, compounded by the fact that

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<sup>5/</sup> E.g., Implementation of the Local Competition Provisions in the Telecommunications Act of 1996, CC Docket No. 96-98, FCC 96-325, released August 8, 1996 at ¶ 4.

<sup>6/</sup> 47 U.S.C. § 271(c)(1)(A).

a new-entrant competitive local exchange carrier ("CLEC") has little assurance of a sufficient market capture rate for the efficient utilization of newly deployed infrastructure. Just as wireless cable (MDS, MMDS) has provided a solution to this problem for cable competition, so will FWA for telephony services. Nortel believes that an FWA service will therefore lead to a more flexible and competitive marketplace in the United States, with manifold benefits for American consumers, and for existing and new carriers.

In addition, an FWA service can quickly and economically provide robust service to consumers (and businesses) that lack adequate phone service, as evidenced by the continuing existence of held orders, party lines and unfilled ISDN requests. In addition, the FWA systems can also be used to provide rapid and economical restoration services in the event of disaster, provide permanent or temporary service at exhibition sites (where demand fluctuates greatly), and provide service at other temporary locations such as construction sites or exploration projects where it might not be feasible to install wireline service.

#### C. Other Alternatives Are Inadequate

Nortel is aware that many wireless operators (including cellular, PCS and satellite) plan to address some of these market sectors. Indeed, Nortel is actively involved in the deployment of many of these various wireless networks. In evaluating many

of these different markets and networks, Nortel has learned that many wireline operators expect the PCS and satellite technologies to play some role in attracting some customers away from the regulated wireline services. Nortel believes, however, that PCS networks are unable to satisfy the full market requirements of wireline equivalent capacity, quality, reliability and transparency of services.

On the other hand, the carriers that Nortel has contacted have been unequivocally impressed by the capability of the emerging systems to provide true wireline equivalence for single and multiple lines for voice, facsimile, modem, data, ISDN and (fractional) T1 delivery under various capacity, density and cost per line situations.<sup>7/</sup> Section II. A. below discusses the relative capabilities of FWA and other wireless services now being offered in greater detail.

#### D. FWA Will Provide Numerous Benefits

Cellular telephone, wireless data, paging and mobile radio services have already demonstrated that wireless technologies can provide mobile communications and information services which are then also used by consumers to supplement or displace some of their fixed services and usage. Likewise, DBS and wireless cable have proven that modern wireless technology

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<sup>7/</sup> However, these same carriers have so far been reluctant to commit resources to develop the appropriate business cases and evaluation projects until suitable spectrum has been allocated that they would be able to acquire.

can displace or supplement fixed CATV (or older technology over-the-air broadcast TV) services and usage in the marketplace. The upcoming LMDS wireless technology will further this trend by providing wireless broadband and wireless ATM access capabilities to displace or supplement fiber and coaxial cable technologies. Thus, carriers and consumers have demonstrated an acceptance of wireless technologies as a substitute for wireline technologies.

The Commission has historically taken a pro-active and constructive role in making spectrum available under appropriate rules to enable these various wireless technologies and services to take root and flourish, and in more recent years the Commission's initiatives have set examples which have been copied or adopted outside the United States, opening export opportunities for U.S. manufacturers, operators and investors. However, Nortel believes that a notable omission from the current U.S. wireless arena is the availability of appropriate spectrum which can be used by wireline equivalent service providers as part of their market and technology planning.

Nortel urges the Commission to make spectrum available so that incumbent and new carriers can use FWA service to address new market opportunities and resolve many of the historic or projected problems and limitations of wireline networks. In addition, such an allocation will create and allow responses to the enhanced competition unleashed by the Telecommunications Act of 1996.

The anomaly is that the rest of the World has already moved much faster to allocate spectrum and deploy products to

harness the benefits of this technology. Indeed, it is U.S. vendors (such as Nortel, DSC and Lucent Technologies) that are currently leading the international market for these FWA systems. By allocating suitable spectrum quickly, the Commission will enable these benefits to spread to the U.S. market, and also strengthen the worldwide position of the U.S. vendors against emerging foreign competitors.

As an additional benefit, if properly structured and located in accordance with current CITELE recommendations, such an FWA service would also improve the harmonization of spectrum management across the Americas, as well as being consistent with the European positions that were referenced by DSC. Such harmonization would free up research and development funds for use in product improvement instead of market adaptation, create scale economies for manufacture of the network equipment and customer equipment, and thereby lead to better products and lower prices for the services. In addition, such harmonization will also enhance opportunities for U.S. manufacturers to export systems to other nations. In order that all of these benefits be realized, Nortel joins DSC in urging the Commission to initiate a rulemaking to allocate spectrum for an FWA service.

E. The Proposals in DSC's Petition Can Be Improved

Nortel differs with DSC's petition with regard to some of the specifics for such an allocation, however. Based on its experiences with deployed FWA systems in other countries, Nortel

disagrees with DSC's claim that operation of FWA systems above 3 GHz is not practical. In addition, as discussed in Section V below, Nortel believes that the total bandwidth required to meet the market requirements for wireline equivalence (as well as to meet various regulatory objectives and technical/service alternatives) is much greater than the amount suggested in the DSC petition. Nortel also believes that the allocation should be configured in a manner so as to ensure the flexibility required by operators (and regulators) for the FWA market to operate effectively. Nortel additionally contends that a broader allocation will permit intraservice competition, and thereby further important regulatory goals. Nortel therefore urges the Commission to allocate 300 MHz of contiguous spectrum to FWA to allow for flexible, competitive services.

## II. Defining Fixed Wireless Access Service

While the Commission will manage FWA as a new "service," the FWA technology will be deployed by carriers to provide wireline equivalent services to end user customers. If properly configured, FWA will provide an end product to the consumer that is transparent and interchangeable with wireline dialtone service, notwithstanding that wireless technologies will be employed. Indeed, at present when dialtone service is provided to the user, the service is the same whether the carrier uses microwave or fiber to connect the networks switches. The end user customer is not buying "wireless and/or wireline-

provided dialtone," and presumably is indifferent to whether the carrier uses wireless services in provisioning his or her telephone service. Thus, Nortel views FWA service as an alternative means of providing wireline equivalent dialtone service, and believes that the technical parameters should be defined so as to meet this goal.

A. FWA Differs From Fixed Services  
Provided Over Mobile Systems

Some "mobile" services are also used to provide service to "fixed" installations.<sup>8/</sup> Much of the discussion concerning this topic within the cellular/PCS industry (of which Nortel is a key participant) focuses on the issue of "toll quality voice" or "near toll quality voice." However, the quality of a conversation is only one of several factors which regulators and carriers have to consider when selecting technology and products for their networks and services. In examining "wireline equivalency," many additional factors need to be considered, including fax capabilities, modem and data transparency, quality and predictability of service, compatibility with existing customer equipment and interfaces, and OAM&P (Operations, Administration, Maintenance and Provisioning) integration. An additional important consideration is the cost, which in turn impact the prices and tariff structures.

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<sup>8/</sup> E.g., Amendment of the Commission's Rules to Permit Flexible Service Offerings in the Commercial Mobile Radio Service, FCC 96-283, released August 1, 1996.



In its earlier comments on the Commission's proposal to allow CMRS providers to offer fixed services, Nortel touched on this issue, and included a chart reflecting these significant factors.<sup>2/</sup> An updated version of this summary chart is included below. As reflected in the chart, Nortel views these two technologies as different and complementary -- PCS/cellular is optimized for mobility (but with some fixed options), whereas FWA service is optimized for wireline equivalence, which is a different market sector.

<b>WIRELINE EQUIVALENCE - TECHNICAL COMPARISONS</b>			
<b>Parameter</b>	<b>Wireline Service Technologies</b>	<b>FWA Service Technologies</b>	<b>CMRS and PCS Technologies</b>
Voice Coding	64 kb/s PCM or analog	32 kb/s ADPCM or 64kb/s PCM	4-16 kb/s compressed coding
Voice Quality	MOS = 4.3*	MOS = 4.0 - 4.3*	MOS = 3.5 - 4.1*
Group 3 Fax Rates	All to 14.4, or 28.8/33.6k when available	Same as wireline	2.4, 4.8, 9.6 or 14.4k (19.2k future on GSM)
Modem Data Rates	All to 33.6k	Same as wireline	2.4, 4.8, 9.6 or 14.4k (19.2k future on GSM)
Digital Data Rates	All to 56/64, 128, 384k	Same as wireline	9.6, 14.4k or 19.2k or Packet Mode
T1/E1 Delivery	Fractional or Full	Same as wireline	Not Practicable
Customer Interfaces	<ul style="list-style-type: none"> <li>° RJ-11 or equivalent</li> <li>° ISDN BRI</li> <li>° Leased Line Standards</li> <li>° Data Standards</li> </ul>	Same as wireline	RJ-11 and data via adaptor boxes on AMPS, PCS or GSM standard air interfaces
Engineered Traffic Capacity per line	1 - 36 ccs	Same as wireline	1 - 10 ccs typical

<sup>2/</sup> Comments of Nortel in WT Docket No. 96-6, submitted March 25, 1996 at Table 1.

<b>WIRELINE EQUIVALENCE - TECHNICAL COMPARISONS</b>			
<b>Parameter</b>	<b>Wireline Service Technologies</b>	<b>FWA Service Technologies</b>	<b>CMRS and PCS Technologies</b>
Economic Access Grade of Service	Better than 0.1% blocking	Same as wireline	Typically 2-20% blocking
Long term Bit Error Rates	1 in 10-6 to 1 in 10-8	Same as wireline	1 in 10-3 to 1 in 10-5
One-way Loop Delay	< 5 milliseconds	< 20 milliseconds	50 - 150 milliseconds
* MOS scale = 1-4.5 basis			

Presently, customers who choose wireline services have a set of expectations and values in mind which are different than when they choose mobile services. It is Nortel's belief (consistent with DSC's petition), that end user customers will not be knowingly choosing an FWA service. Rather, the end users will be purchasing standard wireline services. The choice of technology is a matter for the service provider, and should be interchangeable from the customer's perspective. Customers are unlikely to view wireline service (via FWA or cable) and (fixed) cellular/PCS connections as interchangeable or equivalent in value. Attachment B provides a detailed summary of the service differences which might be perceived by a customer choosing wireline equivalent service via FWA service versus a CMRS/PCS service.<sup>10/</sup>

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<sup>10/</sup> Nortel also believes that the Commission should appreciate these differences in determining how any Universal Service subsidy or funding should be allocated to projects that do not fully conform to standard wireline service criteria.

B. Other Currently Available Wireless Services Would Be Inadequate

Nortel also believes that other current or proposed wireless services (in addition to cellular/PCS) would not prove to be an adequate alternative to FWA for providing wireline equivalent service. For example, satellite services in the C-band, Ku-band or Ka-band are capable of providing high quality, high data rate services. However, they suffer from high loop delay and the cost structure for satellite services renders them an inadequate substitute.<sup>11/</sup> In addition, capacity constraints for the satellite systems would make it difficult for the satellite services to meet the demands that FWA service will fulfill.<sup>12/</sup>

Nortel also believes that the future LMDS service at 28 GHz<sup>13/</sup> and point-to-point service at 38 GHz<sup>14/</sup>, while capable of the necessary quality, are not economical for use for general

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<sup>11/</sup> Moreover, the large antennas needed for C-band and Ku-band transceivers are not well suited to deployment in many locations where service would be needed.

<sup>12/</sup> Although some degree of frequency reuse is made possible through the use of spot beams on the satellites, the size of the area within any one of the spot beams is still sufficiently large such that only a limited number of customers within that area could be served at any one time, rendering satellite services unsuitable for serving as a wireline equivalent for all of the potential users within the spot beam.

<sup>13/</sup> Rulemaking to Amend Parts 1, 2, 21, and 25 of the Commission's Rules, CC Docket No. 92-297, FCC 96-311, released, July 22, 1996.

<sup>14/</sup> Amendment of the Commission's Rules Regarding the 37.0-38.6 GHz and 38.6-40.0 GHz Bands, ET Docket No. 95-183, FCC 95-500, released December 15, 1995.

provisioning of wireline equivalent service. The propagation characteristics at those bands renders them unsuitable for an economical, reliable wide-area wireline equivalent service.

In contrast to these other wireless technologies, FWA service would be specifically designed to serve as an efficient and economical wireline equivalent. As demonstrated by the numerous installations of FWA service in other countries such as the United Kingdom and Finland, a properly designed FWA service can serve as a complement, supplement, substitute and strong competitor to the wireline infrastructure.

### III. Benefits of Fixed Wireless Access Service

Nortel believes that the public interest would be well served by an allocation of spectrum for an FWA service. This will enable new and existing carriers to provide: (i) a rapidly deployable, cost-competitive alternative facilities-based source of wireline service; (ii) new and/or improved dialtone service in areas where service is not now provided at a quality equivalent to wireline offerings in urban areas; (iii) seamless interconnectivity with existing fixed network infrastructures; and (iv) the ability to meet universal service needs in a rapid and more economical manner.

A. FWA Will Enhance Competition

Consumers want (and regulators support) flexibility and choice in the number and types of communications and information services which can be purchased or used at places of residence, work, leisure or on the move. In spite of the many initiatives by the Commission and industry over the past twenty years, and notwithstanding the notable successes in the long distance and cellular markets, there are still a significant number of situations and locations where a real or full choice does not exist for local access services. Moreover, in many of those areas there is unlikely to be alternatives if the choice is limited to cabled access networks (whether fiber, copper or coaxial cable). There are many reasons for this limitation.

Most neighborhoods or subdivisions presently have only one telephone access network and one cable TV network (with or without telephony capability) to the curb or house. Most apartment buildings only allow one telephone operator and one cable TV operator (or Multi-Tenant Service Provider) to service the building, denying the tenants any individual choice as to which operator(s) will provide their service. Likewise, some municipalities and/or developers decide which telephone and cable TV operators can put cables into their sub-division ducts, keeping any decision or choice away from the consumer.<sup>15/</sup>

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<sup>15/</sup> The decision as to which company gets the franchise is typically based on short-term convenience or economic benefits for the developer concerned.

While the 1996 Telecommunications Act is intended to remove some of these obstacles (e.g., § 251(b)(4)'s obligation to make available access to rights of way), and thereby enhance competition, many practical obstacles remain in the way. Most Cable TV Operators and competitive LECs find it uneconomic or impractical to extend their services to many residential, small business, suburban and rural consumers, because of a combination of the up-front infrastructure costs, or the wide geographic distribution of their customers (i.e., cost per subscriber passed), and lower penetration or fill rates (i.e., cost per subscriber connected).

Many competitive LECs and CATV operators have great difficulty determining the best combination of fiber, coaxial cable and copper technologies to use in their access networks to deliver the wider combinations of telephony, entertainment and information services to their prospective subscribers. The problem is compounded by the fact that in many cases the system operators are having to use long-term fixed investment models to support rapidly changing and flexible market conditions or technology advances.

In addition, the public and the municipalities have often resisted the disruption caused by the civil works associated with installing, upgrading or maintaining multiple cabled infrastructures. People are unwilling to tolerate their streets constantly being torn up. Nor is it simple or inexpensive for the different operators and utilities to attempt to coordinate the street works and duct/pole/tunnel sharing that

common use of the wireline infrastructure support mechanisms would entail.

An FWA service solves these economic and logistical problems. The service can be deployed rapidly and economically, without the need to tear up the streets. The cost structure is such that even low density deployment is economical (and increased capacity can readily be added as the number of subscribers grows). Thus, FWA service can help ensure that the enhanced facilities-based competition anticipated by Congress and the Commission fully develops.

B. FWA Will Provide Service To  
Unserved and Underserved Areas

In addition, given the economics of deployment of FWA service, the incumbent carriers could also use this new technology to provide service to unserved or underserved areas quickly and inexpensively, and thereby enhance universal service. Like the United States, many regulators around the world are currently reviewing their universal service policies as competition and deregulation are introduced. Nortel has been working with several of these regulators to identify how wireless technologies might improve or change the situation compared to cabled technologies.

Nortel is participating in a study currently being performed in a developed country with telecommunications networks and policies similar to the United States. That study reviews the circumstances existing in more than five hundred communities

with almost 300,000 present telephone service subscribers, and reflecting approximately 80% CATV availability and 20% cellular coverage. Many of these communities include subscribers requesting additional connections for second line and Internet access, vacation homes requesting full fax/data/ISDN capability, and regulators trying to ensure that the schools, clinics, libraries and public safety services in the communities are brought more into line with the services available in the larger towns and cities. The study found that the CATV and cellular operators in that country cannot justify the build out necessary to serve these low density/low revenue communities. The study also found that the wireline telephone company would like to reduce its maintenance costs, travel times and subscriber complaints/waiting lists, but cannot economically justify the investments without major subsidy from the public sector, or its other customers in the main population centers.

To take one example from the study, there is a community with 550 existing subscribers, of which 150 are on 2- or 4-party line service, and the telephone company is holding some 50 orders for lines which it cannot fulfill (including a small number of ISDN connections which cannot be served by the existing cable pairs, either because special conditioning is required or the subscriber is more than two miles from the remote switch unit (which is served by an under-utilized 150 Mb/s fiber feeder)). The estimated cost to convert the party lines to exclusive service exceeds \$3000 per subscriber, and this



investment would do nothing to help with the held orders, ISDN or reduced CATV/Cellular coverage in the area.

Nortel believes that deployment of an FWA system would provide significant relief. Under the FWA service as proposed by Nortel, the telephone company would install a simple radio tower and site at the end of the fiber feeder, and immediately resolve the party line, unserved and ISDN situations at an installed cost of less than \$1000 per subscriber (excluding the main cell site infrastructure and site construction costs which would be a one-time subsidy). Over the next 10-20 years, it would use the FWA system to meet any further requests for service or upgrades, and to replace any faulty pairs, eventually allowing the telephone company to abandon the exhausted copper plant. The installation and maintenance activities for the FWA system can be franchised out to a local technician within the community, saving on travel costs and delays that would otherwise be provided by the telephone company from the main city fifty miles away.

In addition to these direct and immediate benefits, the community would receive important additional advantages from deployment of the FWA system. The first added benefit is that any subsidy required is a single occurrence and related to the base station site/tower costs (i.e., infrastructure) rather than individual loops to specific subscribers which continue over time. Under this approach, any subsidy has been equitably used to offset the infrastructure cost for this community.

The second added benefit comes from the fact that a tower is now in place (and paid for), and as a result it is far